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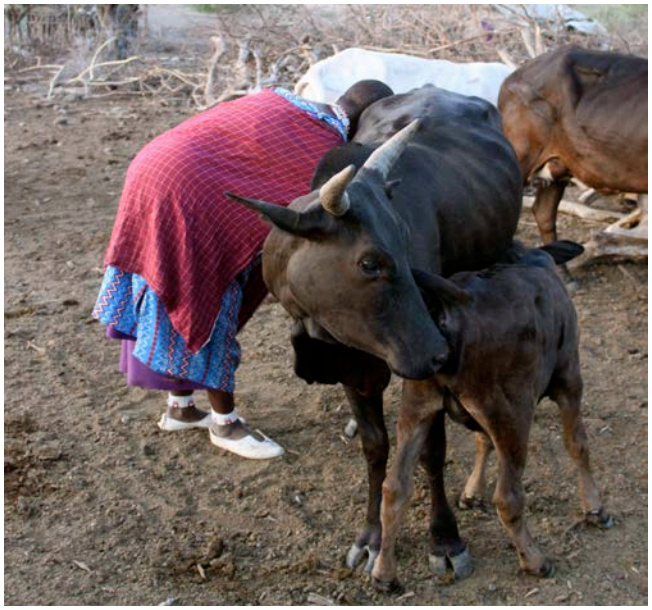
Louise Juhlin

Uppsala 2013

Kandidatarbete i husdjursvetenskap



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ABSTRACT

Livestock of pastoralists provide meat, milk, blood, dung and are useful for transportation purposes. In semi-arid and arid areas with very low precipitation the herder must often walk far distances to feed the livestock. This affects the animals' production, especially of milk. Previous studies have investigated how to improve milk production in terms of milking strategies in cattle. Letting the calf suckle at milking improves milk yield and is also positive for udder health, but shows different impact on growth rate of the calf compared to no suckling at milking. The present study is part of a bigger study and was carried out in Kajiado district at Shompole Conservancy and Ngurumani Escarpment, Kenya. Cross-bred Zebu cattle were used in the study with the objective to control the milking strategy locally. With help of literature, an evaluation of the effects of the milking strategies on calf growth was made. Maasai people are using restricted suckling system, meaning that the calves were separated from the dam during the day, but during milking they were allowed to suckle before, during and after milking. During milking, the milker must balance the needs of the calf against nutritional needs of humans. Most common was to milk three out of four teats, giving the calf access to suckle one teat. Normally the milkers emptied the milked udder quarters completely. Calf size determined both number of teats for the calf and if the milked udder quarters were emptied by the milker or by the calf.

SAMMANFATTNING

Boskap är pastoralisters inkomstkälla som ger kött, mjölk, blod, dynga och används även som dragdjur. I halvtorra och torra områden där nederbörden är mycket begränsad måste herden ofta vandra långa sträckor för att ge mat åt boskapen. Detta påverkar djurens produktivitet, särskilt mjölkproduktionen. Tidigare studier har visat hur man kan förbättra mjölkproduktionen med fokus på mjölkningsstrategi hos nötkreatur. Att låta kalven dia under mjölkningen förbättrar mjölkavkastningen och är också positivt för juverhälsan, men visar motsägelsefulla resultat på kalvens tillväxt i olika, tidigare studier. Studien ingår i en större studie och utfördes i Shompole Conservancy och Ngurumani-sluttningen i Kajiado-distriktet, Kenya. Zebukorsningar användes i studien med syftet att kontrollera mjölkningsstrategier i dessa områden. Med hjälp av litteratur utvärderades vilka eventuella effekter mjölkningsstrategin har på kalvens tillväxt. Kalvar föddes upp genom ”begränsat diande” (restricted suckling), vilket innebär att kalvarna var separerade från modern fram tills mjölkning då de fick dia före, under och efter mjölkningen. Kvinnorna som traditionellt mjölkar korna måste väga människor näringsmässiga behov mot kalvens. Mest förekommande var att mjölka tre av fyra spenar, vilket gjorde att kalven fick dia en spene. Kalvens storlek avgjorde både antal spenar den skulle få tillgång till och om den skulle tömma sin juverdel och de delar kvinnan mjölkat.

INTRODUCTION

Importance of cattle

Maasai people are pastoralists who are known for living in dry areas with low precipitation. Their livestock serve as an important source regarding food supplies and income, partly since their land is less usable for other agricultural purposes. Kenya is one of the countries in Africa were pastoral societies are very common. Prolonged drought can have a major impact on their livelihood by means of animal starving and lack of water availability (Kabubo-Mariara, 2009). Milk and meat are two of the most important supplies for Maasai people. Milk contains essential nutritional substances that are among other things dependent on quality of pasture and the cattle consumption of forage (Dixit *et al.*, 2012). Zebu (*Bos indicus*), a common cattle type in East Africa, have a low milk production but are well adapted to drought and severe conditions (Hansen, 2004). Other important supplies from the animals are skin, blood, dung and they are used in transportation purposes (Blench, 2001).

Herding strategies

Maasai people in the study area live in "bomas", an area surrounded by thorny bushes where small houses are deployed. The houses in the boma are simply built out of wood, dung and mud and they usually have one house as kitchen and others for sleeping space. The thorny bushes function as a home range and protection against predators like lions. Within the enclosure cattle, sheep, goats, donkeys and their offspring are separated in smaller enclosures during night, with no feed access. The bomas can either be permanent or temporary. During daytime cattle and shoats (sheep and goats) are often herded separately but in the same area, away from the boma. There are no separate places for milking; it is performed wherever the cow is standing.

The production of milk to provide and sustain the family is dependent on the cattle's forage intake and the quality of forage (Dixit *et al.*, 2012). In order to feed their livestock the herders move were the pasture is available (Degen, 2007). "Tracking" and "linka system" are two herding strategies described by Butt (2010). Tracking implicates that the herder searches for a variation of forage plants and thereby other and better pastures during herding, partly by watching the animals´ behaviour and discussing with other herders were better quality of grass can be found. This system is primarily used during dry season when the pasture supply is limited. Using the "linka system" on the other hand, Maasai people let their animal graze early in the day and closer to the boma and later in the day but further away. Walking shorter distances with the cattle decreases the energy cost of the cow and leaves more time for grazing (Butt 2010). It also decreases the workload of the herder (Butt, 2010). Although, if the forage is of good quality further away from the boma, the forage intake per hour can be higher than grazing on lower quality of pasture that is closer to the boma (Jung *et al*., 2002). The "Linka system" is mainly used during the wet season when the pasture access is better than during dry season. According to Butt (2010) significant differences in the pattern of cattle mobility between dry and wet season were shown in the study. During dry season the radius increased with two kilometres and the walking distance increased by three kilometres a day. The duration of grazing behaviour also increased, by 26 minutes (Butt, 2010). A long walk can make the cows very exhausted and therefore not able to graze. There is also a risk that it is very hot in the middle of the day, which has the same effects on the cows (Jung *et al*., 2002).

Finding good pastures is not the only challenge during herding. The herder must take into considerations other factors that can affect the herd and the herding. Some areas as more predator-dense and others may have a higher risk for ticks and parasites or poisonous plants (Butt, 2010). According to Ayantunde *et al.* (2000) night grazing leads towards increased milk production, better body condition and prevention of diseases, but may also involve difficulties like staying awake and animals destroying crops. In addition to the factor that the grazing areas are limited, especially during dry season, the cattle do not have free access to water. In some cases water is only ingested once a day. Water is found in the rivers or in rain filled puddles. A lactating cow needs to increase the water intake considerably since the total amount water loss in the body increases during lactation (Sjaastad *et al*., 2010).

Cattle breeds

The livestock breeds used in this study are Sahiwal and Boran, originated from Zebu, in hope of improving the productivity. Sahiwal cattle performs better in both milk and meat production compared to pure zebu (Falvey & Chantalakhana, 1999). Boran is a beef breed and like Sahiwal tolerant to heat, ticks and parasites (Borankenya, 2013). Zebu cattle can efficiently digest forage with lower contents of nutrients (Hansen, 2004).

Improving milk production

During milking, the milkers, who are usually women, must balance calf survival and growth against the nutritional needs of humans. Insufficient amounts of milk affect growth rate and immune system of the calf as well as human nutritional needs. A more high producing cow provides more saleable milk and thereby increases living standards. A calf given enough milk grows better and provides a better carcass weight, which is also economic revenue. Milk available for the calf is partly determined by the milker, which consequently affects the calf growth (Coulibaly & Nialibouly, 1998). Genetics, food consumption, health and lactation stage are only a few factors that can affect milk yield and milk composition in cattle (Bonfou *et al.*, 2005). Several studies have been carried out on milking strategies and their impact on milk yield. Most authors agree that total milk yield (ingested milk by the calf plus milk extracted by the milker) increases if the calf is allowed to suckle at one or more occasions during milking (Alvarez et al., 1980; Coulibaly & Nialibouly, 1998; Fröberg *et al*., 2007). Letting the calf suckle also improves udder health. Both calf presence and time at calf weaning affects lactation length of the cow (Fröberg *et al*., 2007; Sidibé-Anago *et al.*, 2008).

Objectives

“The cattleman’s project” and ”Rebuilding the pride” are two projects performed by Lale’enok Resource Center, commissioned by the African Conservation Center in co-operation with Soralo (South Rift Association of Land Owners). The aim of these projects is to understand the movement pattern and interactions between wildlife and livestock to minimize the conflicts between predators and humans. By understanding the movement of wildlife, Maasai people can easier herd their cattle and thereby improve livestock productivity (Soralo, 2013). Together with Soralo, Lale’enok Resource Center is now working on a project that comprises improvement of livestock productivity in different regions for Maasai people, for example including husbandry techniques and breeding improvements. Within these larger projects, this bachelor thesis has been focusing on milk

production with the aim to understand how the Maasai people in Shompole Conservancy and Ngurumani Escarpment choose to improve the productivity of their cattle in terms of milking strategies. The following questions were asked:

* What kind of milking strategy is used and how does it affect milk production?

* In what way is the calf growth and health affected by the milking strategy?

Results from this study might help farmers in these areas to better understand how the milk yield can be adjusted and how to utilize the animals in a better way. The knowledge of this study can hopefully be applied in adjacent areas with similar milking strategies and rearing systems.

MATERIALS AND METHODS

Eleven local Maasai people were hired as resource assessors to walk with the cattle for 15 days a month, following one or two herds each. Hence, 13 herds were totally followed. The analysed data was collected from February to April 2013 (data from February and March were received from the resource assessors) during the end of the dry period and start of the rainy period at Shompole Conservancy and Ngurumani Escarpment in Magadi, Kenya. The herds consisted of Boran and Sahiwal cattle and were kept within the bomas at night when not grazing. Recordings included information about rainy/dry season, date, age of herder and status of the boma (permanent or temporary). All animal management routines followed standard practice in the herd.

Study area

Three ecosystems could be distinguished in the study area; the semi-arid area, the swamp area and the Ngurumani Escarpment. The semi-arid area is typical for large parts of Kenya with dry savanna and scattered trees and shrubs. The irregular rainfall compels the herder to walk far distances from the boma. During rainy season the distances become shorter to the boma due to the access of grass and shrubs. The swamp area is a flooded area during rainy season, which makes it attracting for the herders to let their cattle graze in this region. During dry season the grass is high but dry and the ground is solid. In Ngurumani Escarpment farming is possible all year round due to permanent small streams. In this village people often keep fewer animals because they can make a living on agriculture. Access to pasture is harder than in the other regions and trespassing can occur on the farming areas. If crops are destroyed the cattle owner becomes liable to pay compensation. In this case keeping fewer animals may be more functional (Naurori, 2013 personal communication).

In most parts of Kenya dry season last from May to September. In November to January occasional rain returns (short rains) and long rains fall during March to May (Kabubo-Mariara, 2009). In average 250 mm rain falls annually in the study area near Lake Magadi (Morris *et al.*, 2008).

Herd monitoring

Usually the herder left the boma with the herd in the morning between 8.00-10.00 a.m. and returned around 6:00 p.m. In the swamp area and Ngurumani Escarpment the herders usually chose to divide the herding into short walk and long walk, earlier mentioned as the "linka system". When dividing the herding they first herded the cattle between 6:00-9:00 am, went back home and left again between 12:00-18:00 pm. Before the herding started the resource assessor interviewed the herder about the chosen areas to graze on. The herder had to consider risks from predators, ticks, diseases and quality of food before choosing a grazing area. Every 30 minutes during the day, starting at the boma before leaving, GPS coordinates and waypoint numbers were recorded. Within these 30 minutes they also recorded location and the appearance of the environment within that location (dominant trees, shrubs, grass and herbs), risk factors (perceived risk and what kind of risk) (Tab. 1) and information about the herd and herder (spread index, herder location, herder activity, furthest animal, herd visibility). Every 10 minutes, the behavior of six focal animals (either moving, standing, lying, grazing, browsing, drinking, ruminating, socializing, eating on seeds or fruit) (Tab. 2), food quality and herd activity were recorded. Food quality was estimated using a scale from 1-5 with 1 as the poorest and 5 as the best quality. Every 10 minutes two out of eleven resource assessors also recorded humidity and temperature; the other ones had received no such equipment. They also took a picture of the area and recorded the picture number every 30 minutes. Every second hour during the day each resource assessor had a 30 minutes break (an example of a "Herd monitoring" paper is shown in appendix 1).

Table 1. Description of risk factors that might occur during herding. Recorded every 30 minutes.

Risk factors	**Perceived risk**	**Description**
Lions (L)	High, Medium or Low	Risk from lion attacks on cattle
Tsetse flies (TS)	High, Medium or Low	Risk from tsetse flies affecting the cattle negative
Ticks (T)	High, Medium or Low	Risk from ticks affecting the cattle negative
Poisonous plants (P)	High, Medium or Low	Risk from poisonous plant affecting the cattle negative
Trespassing (TR)	High, Medium or Low	Cattle entering crop production area. Could only occur in Ngurumani village where crops are grown

Table 2. Description of the behavior of six focal animals per herd, and herd activity, recorded every 10 minutes.

Animal behavior	**Description of behavior**
Moving (M)	Walking or running, no other visible activity
Standing (S)	Standing still, no other visible activity
Lying (L)	Belly touching ground
Grazing (G)	Muzzle in contact with grass and herbs, or walking having grass or herbs in the mouth
Browsing (B)	Muzzle in contact with shrubs or trees, or walking with shrubs or leaves in the mouth
Drinking (D)	Animal taking in water from river or puddle
Standing/Ruminating (S/R)	Re-chewing previously digested food, standing still
Lying/Ruminating (L/R)	Re-chewing previously digested food, lying down
Standing/Socializing (S/C)	Two or several animals interacting with each other, standing still
Moving/Socializing (M/C)	Two or several animals interacting with each other, moving
Eating on seeds or fruit (S/F)	Eating on seeds or fruit lying on the ground or directly from plants or trees

Milking

Women in the boma milked the cows in the morning around 07.00 a.m. (earlier or later when dividing the herding) and in the evening around 07.00 p.m. Out of the six focal animals, three were lactating and three were dry. The amount of milk collected by the milker, from the lactating cows, was measured (calf's consumption not included) and recorded by the resource assessors at morning and evening 15 days a month. This was done one day after the parameters within the data recording of "Herd monitoring". The procedure was chosen to be able to compare how milk yield fluctuates depending on the recorded parameters at herding. The cows were milked by hand wherever they were standing. During day the focal animals were grazing with the herd and distance to pasture varied. Resource assessors also recorded breed, animal ID, age of mother, age of youngest calf, number of active teats, number of milked teats, milk amount extracted by the milker, milk for family, milk for sale, latest water intake, days since cow dip (for preventing parasite diseases), last grazing area and last grazing area-vegetation. Resource assessors also made separate recording about body condition of the herd and herd structure, but it was not possible to get access to this data and it could hence not be used in this bachelor thesis.

Observation of resource assessors and observers data collection

In the field ten out of eleven resource assessors were observed one time each during the collection of data within the project part "Herd monitoring" and "Milking" to see if the data collection was made in a correct way. In an interview each resource assessor explained how the data collection was performed and their interpretation of the different parameters recorded. By asking if the resources assessors measured milk yield with or without milk foam in the measuring cup the observers controlled the measurement method. Correct method was to measure without foam. The observers documented the milking strategy by using a video camera. A total of 48 cows from ten different bomas were filmed during milking procedure. At the same time the observers recorded whether the udder was emptied or not during milking by assessing the calves´ behaviour. If the calf switched teat within 2-3 seconds, the udder was considered empty. The observers also recorded how many teats were milked, and how many teats the calf was given (Tab. 3).

Table 3. Descriptions of recorded parameters by the observers.

Parameters recorded by the observers	**Description**
Cow number	Identification of the cow
Active teats	Number of quarters that functioned. 1-4 quarters
Number of teats milked	Number of quarters that were milked by hand. 1-4 quarters
Emptied udder	Information about if the udder was emptied or not according to the milker and the observers

RESULTS

Since a large amount of collected data from the resource assessors was unfortunately found not to be reliable it could not be used in this bachelor thesis. This applies primarily to data about milk yield. The results of data that were considered reliable are presented below. The data are descriptive only, since the amount was too low to allowing statistical analyses.

Milking strategy

The Maasai people used a restricted suckling system (RS), which means that the calves were separated from their dam until it was time for milking. Before milking, the calf stimulated milk let-down and the cow was hand-milked by the women. The calf was allowed to suckle the teats that were not milked during milking. After the hand milking was finished, the calf was allowed to suckle all teats.

Milked teats and emptied udder

An overview of the number of cows used in this study and the percentage of milked teats (mean value) is presented in table 4. Even if the mean value of milked teat is two out of

three teats, it was most common to milk three out of four functioning teats and give one teat to the calf. Second common was to give the calf two teats to suckle (Tab. 5).

Table 4. Results of number of cows that were milked and the mean value of how many teats that were milked.

Variable	**Total number of cows (N)**	**Milked teats (% of intact teats)**	**Standard error**
	48	67.71	+/- 2.31

Table 5. Results of how many teats that were used for milking and given to the calf on number of cows.

Number of cows	**Number of functioning teats**	**Percentage of teats used for milking**	**Number of teats for the calf**
18	2 or 4	50	2
3	3	66.7	1
22	4	75	1
5	4	100	0 or 4

It was most common for the milker to empty the milked udder quarters as good as a human hand can do. Second common was to only take parts out of it by hand and let the calf empty even the milked udder quarters. The milker and observer seemed in a few cases not to be aware of if the udder quarters were emptied. In four cases, the milker claimed that the teats were empty but the calf's behaviour indicated that there was more than only residual milk left (Tab. 6).

Table 6. Results of emptied udder.

Number of cows	**Emptied udder**
5	No information about emptied udder
33	The milker emptied the milked udder quarters
6	The milker did not empty the milked udder quarters
4	The milked udder quarters were emptied according to the milker but calf indicated that milk was left

DISCUSSION

Milking strategy

Earlier studies on the restricted suckling system that the Maasai people are using shows that it appears to have a positive effect on total milk yield. Fröberg *et al.* (2007) reported that cows had a higher saleable milk yield if the calves were raised in a restricted suckling system than in artificial rearing system (AR). Coulibaly & Nialibouly (1998) and Yilma *et al.* (2006) also reported that total milk yield including the milk given to the calf, increases if the calf suckles before milking compared to no suckling before milking. Maasai women that are milking their cows have to balance calf health and growth against humans' nutritional needs. A higher total milk yield should be able to supply both calves and humans better compared to a lower milk yield. However, by trying to increase milk production there is a risk of disturbing an already sensitive state. The low quality of grass that the cows are feeding on cannot meet the animal's needs during lactation, especially during dry season. Furthermore, this affects reproductive efficiency by delaying oestrus (Tinoco-Magana *et al*., 2011). My speculation is that the increase in milk yield that restricted suckling systems provides, does not warrant drastic changes in feed ration. The increased amount is probably not sufficiently large to lead to nutritional problems of the cow. The fact that they are using restricted suckling and no other system, for example only use the calf for milk let-down and then bucket-feed it, suggest that it is working for them.

Not only suckling system affects the milk yield, also the length of the suckling period may have an impact on milk yield. Sidibé-Anago *et al.* (2008) describe that suckling for five month increased the total amount of milk by 49% and saleable milk by 32% compared to suckling for three month. Msanga & Bryant (2004) on the other hand reported that earlier weaned calves (12 instead of 24 weeks), increased the milk production of the cow on average through the lactation, although this result was not statistical significant. Furthermore, cows whose calves were weaned at three months dropped in milk yield much earlier after weaning than five month weaned calves (Sidibé-Anago *et al.,* 2008). Normally the calves in my study started to graze around two to three months of age, but were still allowed to suckle (Naurori, 2013 personal communication). A speculation is that the condition of both the calf and the cow determines whether the calf is weaned or not; the exact age is not of major importance. The milker can try to prolong the suckling due to the demand of milk for the family by only letting the calf stimulate milk let-down but not letting it suckle. According to Mejia *et al*. (1998) the RS calves prolonged the cows' lactation period by the suckling compared to the AR calves. However, it is also possible that the cow is not capable of producing more milk because of poor food supplies. The calves may be weaned earlier than they should because of drought during the dry season. A young calf that is weaned early endangers calf growth and survival (Mandibaya *et al*. 2000). My speculation is that it would be better for both calves and cows if parturition did not occur during the driest period, since the risk of prematurely dried off cows would be higher during dry season than during the wet season and thus have a negative effect on calf growth and health.

Herding

As mentioned earlier different herding strategies are used, depending on season, to increase the forage intake and milk production (Butt, 2010). However, it is possible that some grazing areas have a higher occurrence of ticks or poisonous plants or are more predator-

dense. This can affect the animals' health and also decrease the forage intake due to the stress that the animals experience when predators are present (Jung, 2013 personal communication). The herder can therefore not just consider quality of forage when herding their cattle, which affects the production of the animals. Ayantunde *et al.* (2000) describe night grazing as an alternative to increase the milk production. However, the risk of lion attacks on cattle during night is higher, which forces the herd in this study to graze during daytime (Naurori, 2013 personal communication). A cow can otherwise be an easy target for a lion.

Udder quarters for the milker and the calf

Results showed that a third of the teats were saved for the calf in general and the collected milk was used by the family but not for sale. So the calf was allowed to suckle one teat completely and the residual milk on all teats when the milker was finished. According to Fröberg *et al.* (2007) and in agreement with Alvarez *et al.* (1980) cows that were suckled by their calves had better udder health respectively reduced prevalence of subclinical mastitis. My personal observation during milking was that the milker smeared faeces on the teat/teats not aimed for the calves, which aimed at stopping the calf from suckling the "milker's teat". By heating the milk and mix some sort of tree ingredients the bacteria were removed from the collected milk, according to the milker (Naurori, 2013 personal communication). I cannot confirm if this is true. Faeces from the cow contain bacteria like *Escherichia coli* that can cause clinical mastitis (Tadesse & Dessie, 2003; SVA, 2013). Traditional procedures and lack of knowledge could be reasons for the implementation. According to the results some of the teats were neither milked nor given to the calf on a few cows, which may be due to incidence of mastitis. Bofou *et al.* (2005) reported that a high somatic cell count (SCC) was linked to a high prevalence of subclinical mastitis and affected the milk content (significantly increases protein, fat and the total solids contents). According to Rajala-Schultz *et al.* (1999) mastitis decreases total milk yield during the entire lactation. In my study, four out of 48 cows had one non-functioning teat each, which indicates that the udder health was relatively good on these animals. Just informing the milkers about the importance of clean teats before milking should be an easy way of improving the hygienic aspects during milking. Even if they cannot clean the teat with water, a dry, less dirty teat would be more hygenic than a teat with faeces on. Since the total amount of milk is already low, mastitis in cows is not desirable since milk yield decreases.

Emptied udder

When studying if the udder was emptied during milking result shows that it was most common for the milker to empty the milked udder quarters, but the calf was allowed to suckle all teats after milking. A calf that is allowed to suckle after milking increases prolactin release in the cow. This will enhance milk yield during next milking occasion in the onset of lactation stage according to Algers & Jensen (1991). It is important for the milker to empty the udder quarters to receive as much milk as possible since the cows are low milk producers. The fat content in the milk that is extracted increases during the course of milking (FAO, 2013). If the calf suckles the residual milk after milking the higher fat content is left for the calf. Next milking will be slightly reduced in fat content since the calf empties the udder more completely than the milker can do (FAO, 2013). This is supported by Fröberg *et al.* (2007) study whose cows of the RS calves had lower fat content in the collected milk than cows of the AR calves. If the fat content is reduced after the calf

suckled, the family will also get less fat content in the collected milk. However, the milker is less able to empty the udder and since calf suckling seem to have a positive affect on both udder health and milk yield, this would be considered as a minor problem. Hopefully the higher amount milk can replace the slightly lower fat content. In four cases in my study the milker and the observer seemed not to be correct in their judgement of emptied udder. Possibly the milker was not able to completely empty her quarters but the calf was. According to Sidibé-Anago *et al.* (2008) milk fat increased at three-month weaned calves but resulted in lower milk yield in total. Data about emptied udder quarters were missing in five cows; this was due to lack of communication during data collection.

Calf growth

No data has been recorded on calf growth in this study. However, our result shows that sometimes the milker did not empty the milked udder quarters in all cows or left more than one teat for the calf. A smaller calf was allowed to empty all quarters or is allowed to suckle more than one teat according to the milker. Only five cows were milked on four teats, which can also be explained by calf size. My speculation is that a bigger calf might share all teats with the milker during the weaning process and is used only for milk let-down stimulation, and provide milk for the family instead. During field studies, the women pointed out that giving the calf to much milk would cause diarrhoea. Contaminated milk can cause diarrhoea, but if the teat is clean, this should not be a problem. However, each meal should not be too big and it is better to divide into smaller doses (Agenäs, 2013 personal communication). Earlier studies are not all in agreement regarding how the calf growth is affected by weaning or suckling system. According to Coulibaly & Nialibouly (1998), calves with free access by suckling their dams until saturation were heaviest at weaning and grew faster from birth to weaning compared to the other groups. However, Msanga & Bryant (2003) reported that bucket-reared calves gained faster than suckled calves in pre-weaning stage. Msanga & Bryant (2004) could not see any significant results on calf growth in calves that were weaned after 12 weeks or 24 weeks, respectively. My speculation is that the daily collected milk is of more value than trying to increase the calf growth rate for selling meat. Even if the owners would want to improve calf growth rate it is hard (due to poor nutritional access), but it is also of great value to have many live animals since it indicates high status for Maasai people. Furthermore, if you slaughter a cow it can also be hard to store the meat if you cannot sell it.

Unlike many of the previous studies the calves and cows in this study had no access to molasses, hay or any concentrate. These calves and cows were only fed milk and available grass with varying quality respectively. The ingested amount of water also varied each day. This changes the preconditions since it is harder for these cows to sustain a stable milk production and thereby a more stable calf growth. Instead, they are affected by season and climate. Reasons for not giving concentrate or hay at the time can be dependent of the costs and the purchased forage can also be hard to transport. During the wet season the roads are often destroyed because of the massive rainfall. However during the wet season the pasture availability is better and the need for purchased hay is lower. By increasing milk yield the family can sell the milk, which provides money. On the other hand, people in Shompole Conservancy have a long distance to transport the milk (for example to the village) and no place to cool the milk due to absence of electricity. Mode of transportation would be walking, which is time consuming and strenuous. By giving the calf more or at least enough milk, the calf can have a stable growth rate. Calves can be sold as live animals (or

slaughtered) to provide money for the family. In Ngurumani escarpment the village is closer to the boma and selling milk would be easier due to the shorter distance.

CONCLUSIONS

Due to quality problems, we were unable to use a considerable amount of the data from this study, and it was not possible to make comparisons of e.g. milk yield and milking strategy or forage quality and milk yield. Hence, no comparison of how the milk production was affected by the milking strategy or how this affected the calves could be made. Nevertheless, the results showed that the Maasai people are using restricted suckling system, which has positive affects on milk yield according to previous studies. The fact that the calf is allowed to suckle also has a positive effect on the udder health. The results also showed that calf size often decides how many teats that were milked and if the milker emptied the quarters or let the calf do it. For future recommendations the bigger study needs to improve the work of the field assistants to get reliable data. More communication between resource assessors and people in charge is necessary. Resource assessors also need more training to be able to make the data collection in a correct way. A study with fewer people involved will probably be more reliable regarding data collection. It could also be more reliable if recordings about lactation stage and parity of the cow are made separately, to minimize human bias (the result shows an inaccurate impression of reality on total milk yield if the cows are not in the same lactation stage for example). It also gives a wider qualification about the lactation in these dry areas, which can be applied when improving milk production. A follow-up on calf growth and health should also be made, since these animals are often recruited into the same herd. People in these areas are living traditionally, and do not perform modern milk production. Since I know that projects for improving milk production is already ongoing I would suggest that to be able to improve milk production in these areas, the owners should work more on breeding programs, by selecting on both health and production.

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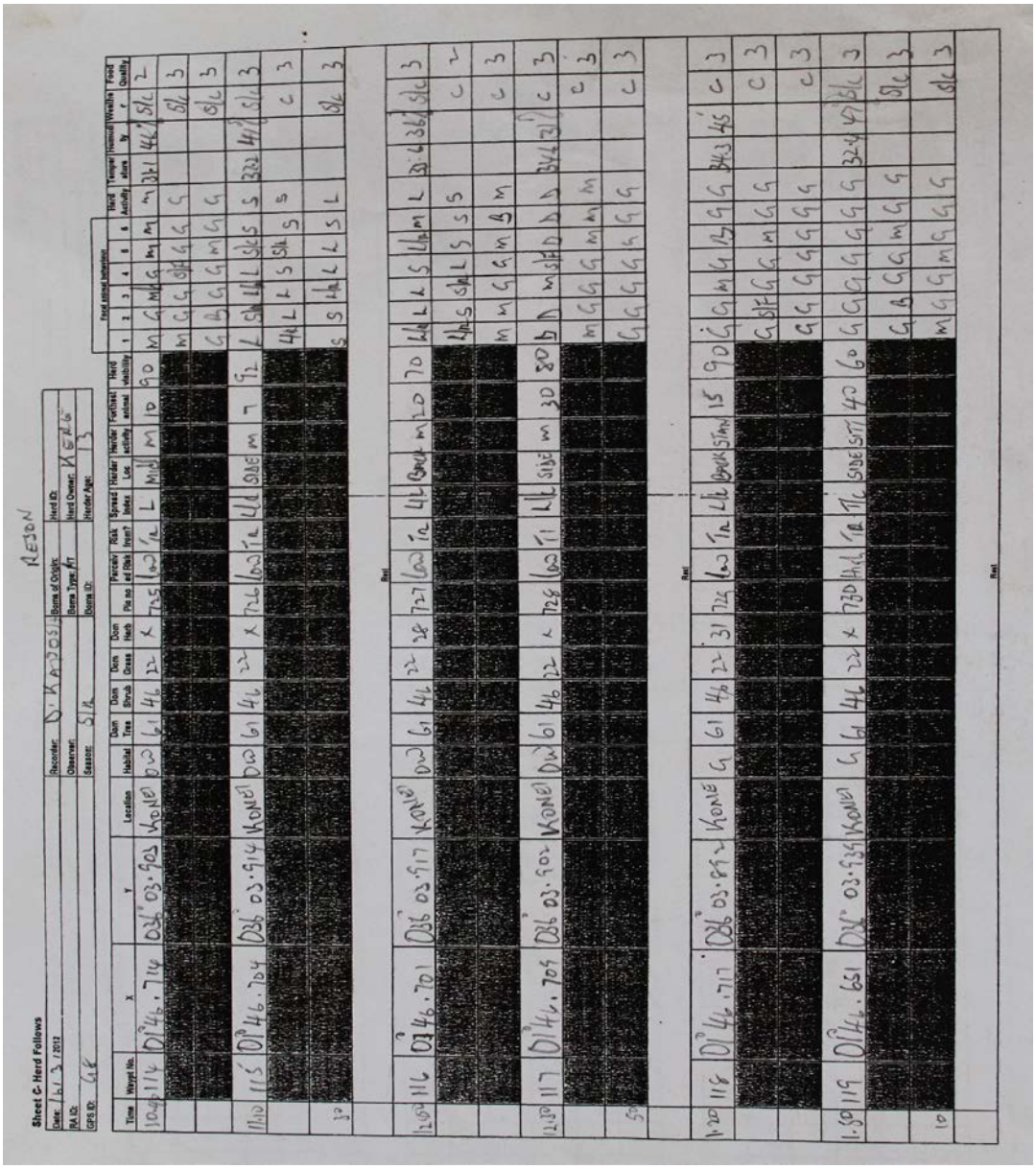
APPENDIX 1

Appendix 1. Example of resource assessors data recording from “Herd monitoring”.



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